

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

1. **(Currently Amended)** A method of manufacturing a metal oxide, metal ~~oxidhydroxide~~ oxyhydroxide or metal hydroxide product, said product having a sub-micron primary particle size, comprising:

- introducing a solid reactor filling material into a reactor,
- introducing a metal-containing precursor into said reactor,
- introducing a co-solvent into said reactor,
- introducing a supercritical solvent into said reactor, ~~thereby~~
~~—establishing whereby~~ a contact between the metal-containing precursor and the co-solvent is established, thus and
~~—resulting in the formation of~~
- forming said product ~~is~~ in the proximity of said solid reactor filling material.

2-71. (Canceled)

72. **(Currently Amended)** An apparatus for manufacturing a metal oxide, metal ~~oxidhydroxide~~ oxyhydroxide or metal hydroxide product, said product having a sub-micron primary particle size, said apparatus comprising:

- a solid reactor filling material in a reactor,
- means for introducing a metal-containing precursor into said reactor,
- means for introducing a co-solvent into said reactor,
- means for introducing a supercritical solvent into said reactor,

- said reactor ~~intended as a space for~~ adapted to establishing ~~establish~~ a contact between the metal-containing precursor and the co-solvent, and

- said reactor ~~intended as a space for the formation of~~ adapted to form said product in the proximity of said solid reactor filling material.

73. (Currently Amended) ~~An apparatus according to claim 72~~ The apparatus of claim 72, further comprising means for introducing the solid reactor filling material into the reactor.

74. (Currently Amended) ~~An apparatus according to claim 72~~ The apparatus of claim 72, further comprising means for extracting the solid reactor filling material from the reactor.

75. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the ~~formation~~ forming of said product takes place by a process involving at least a sol-gel reaction.

76. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the metal oxide, the metal ~~oxidhydroxide~~ oxyhydroxide or the metal hydroxide product is substantially crystalline.

77. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the metal oxide, the metal ~~oxidhydroxide~~ oxyhydroxide or the metal hydroxide product is substantially amorphous.

78. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the metal oxide, the metal ~~oxidhydroxide~~ oxyhydroxide or the metal hydroxide product is a mixture ~~of several~~ comprising at least two different phases.

79. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the introduction of the solid reactor filling material, the metal-containing precursor, the co-solvent, and the supercritical solvent into the said reactor is done in arbitrary order.

80. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein at least one of the solid reactor filling material, the metal-containing precursor, the co-solvent, or the supercritical solvent is mixed with at least one of the solid reactor filling material, the metal-containing precursor, the co-solvent or the supercritical solvent before introduction into said reactor.
81. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the metal oxide, the metal ~~oxidhydroxide~~ oxyhydroxide or the metal hydroxide product is manufactured in a mode comprising ~~selected from the group consisting of:~~ a batch mode, a quasi-batch mode ~~and or~~ a substantially ~~continues~~ continuous mode.
82. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein a temperature in the reactor during the ~~formation~~ forming of said product is kept at a fixed temperature.
83. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein a temperature in the reactor during the ~~formation~~ forming of said product is performed at an increasing temperature.
84. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein a temperature in the reactor during the ~~formation~~ forming of said product is performed at a decreasing temperature.
85. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein a temperature in the reactor during the ~~formation~~ forming of said product is performed ~~at using~~ a temperature profile including an arbitrary combination of at least two of the following temperature profiles: a fixed temperature, an increasing temperature, ~~and~~ a decreasing temperature.

86. (Currently Amended) ~~A method according to claim 82,~~ The method of claim 82, wherein the maximum temperature in the reactor during the ~~formation~~ forming of said product is ~~maximum 400°C, maximum 300°C, maximum 200°C, maximum 100°C, or maximum 50°C.~~ 400°C, 300°C, 200°C, 100°C, or 50°C.
87. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein a pressure in the reactor during the ~~formation~~ forming of said product is kept at a fixed pressure.
88. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein a pressure in the reactor during the ~~formation~~ forming of said product is performed at an increasing pressure.
89. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein a pressure in the reactor during the ~~formation~~ forming of said product is performed at a decreasing pressure.
90. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein a pressure in the reactor during the ~~formation~~ forming of said product is performed ~~at~~ using a pressure profile including an arbitrary combination of at least two of the following pressure profiles: a fixed pressure, an increasing pressure, and a decreasing pressure.
91. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the supercritical solvent is CO₂, and the minimum pressure in the reactor during the ~~formation~~ forming of said product is ~~minimum 74 bar, more minimum 80 bar, minimum 90 bar, or minimum 100 bar.~~ 74 bar, 80 bar, 90 bar, or 100 bar.
92. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the supercritical solvent is CO₂, and the minimum temperature in the reactor during the

~~formation forming~~ of said product is ~~minimum 31°C, minimum 43°C, minimum 100°C, minimum 200°C, minimum 300°C, or minimum 400°C.~~ 31°C, 43°C, 100°C, 200°C, 300°C, or 400°C

93. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the supercritical solvent is isopropanol, and the minimum pressure in the reactor during the ~~formation forming~~ of said product is ~~minimum 47 bar, minimum 80 bar, minimum 90 bar, or minimum 100 bar.~~ 47 bar, 80 bar, 90 bar, or 100 bar.

94. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the supercritical solvent is isopropanol, and the minimum temperature in the reactor during the ~~formation forming~~ of said product is ~~minimum 235°C, minimum 250°C, minimum 270°C, minimum 300°C, or alternatively minimum 400°C.~~ 235°C, 250°C, 270°C, 300°C, or 400°C.

95. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the supercritical solvent is in supercritical phase before the introduction into said reactor.

96. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the supercritical solvent is brought into a supercritical phase after the introduction into said reactor.

97. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the maximum time ~~of for~~ the ~~formation forming~~ of said product is ~~maximum 1 hour, maximum 0.75 hour, or maximum 0.5 hour.~~ 1 hour, 0.75 hours, or 0.5 hours.

98. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the maximum time ~~of for~~ the ~~formation~~ forming of said product is ~~maximum 8 hours, maximum 6 hours, or maximum 2 hours.~~ 8 hours, 6 hours, or 2 hours.
99. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the maximum time ~~of for~~ the ~~formation~~ forming of said product is ~~maximum 24 hours, maximum 17 hours, or maximum 10 hours.~~ 24 hours, 17 hours, or 10 hours.
100. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, further comprising introducing a plurality of different metal-containing precursors into said reactor.
101. (Currently Amended) ~~A~~ ~~A method according to claim 1,~~ The method of claim 1, further comprising introducing into said reactor a metal-containing precursor which is a metal alkoxide.
102. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, further comprising introducing into said reactor a metal-containing precursor ~~selected from the group consisting of:~~ comprising: titanium tetraisopropoxide, titanium butoxide, titanium ethoxide, ~~and~~ titanium methoxide, and mixtures thereof.
103. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, further comprising introducing into said reactor a metal-containing precursor ~~which is selected from the group consisting of:~~ comprising: aluminium isopropoxide, ~~and~~ aluminium-sec-butoxide, and mixtures thereof.
104. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, further comprising introducing into said reactor a metal-containing precursor which is magnesium ethoxide.

105. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, further comprising introducing into said reactor a metal-containing precursor which is a metal salt.
106. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, further comprising introducing into said reactor a metal-containing precursor which is $\text{Ti}(\text{SO}_4)_2$.
107. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, further comprising introducing into said reactor a metal-containing precursor ~~selected from the group consisting of:~~ comprising: TiCl_4 , ~~and~~ AlCl_3 , and mixtures thereof.
108. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the co-solvent ~~is selected from the group consisting of:~~ comprises: water, ethanol, methanol, hydrogenperoxide, ~~and~~ isopropanol, and mixtures thereof.
109. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein a plurality of different co-solvents is introduced into said reactor.
110. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the solid reactor filling material functions as a heterogeneous catalyst.
111. (Currently Amended) ~~A method according to claim 108,~~ The method of claim 108, wherein the solid reactor filling material comprises at least one promoter.
112. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the solid reactor filling material includes at least one ~~fibre~~ fiber.
113. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the solid reactor filling material includes a powder.

114. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the solid reactor filling material has ~~the a~~ shape ~~selected from the group consisting of:~~ comprising: a sponge, a grid, a wad of ~~fibres~~ fibers, and a sheet.
115. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the solid reactor filling material has a substantially porous structure.
116. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the solid reactor filling material has a size and shape capable of substantially confining the metal-containing precursor to a limited part of the reactor.
117. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the solid reactor filling material comprises a polymer.
118. (Currently Amended) ~~A method according to claim 117,~~ The method of claim 117, wherein the polymer comprises: polystyrene (PS), polypropylene (PP), polyethylene (PE), polyvinyl chloride (PVC), polyvinylidene chloride (PVDC), ~~or~~ polyvinyl acetate (PVAc) or mixtures thereof.
119. (Currently Amended) ~~A method according to claim 117,~~ The method of claim 117, wherein the polymer ~~is selected from the group of:~~ comprises: acrylic polymer, fluorinated polymer, diene polymer, vinyl copolymer, polyamide polymer, polyester polymer, polyether polymer, ~~and~~ polyimide polymer, and mixtures thereof.
120. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1, wherein the solid reactor filling material comprises a metal.
121. (Currently Amended) ~~A method according to claim 120,~~ The method of claim 120, wherein the metal comprises: titanium, ~~aluminium~~ aluminum, zinc, vanadium, magnesium, zirconium, chromium, molybdenum, niobium, tungsten, copper, ~~or~~ iron, or mixtures thereof.

122. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,
wherein the solid reactor filling material comprises a metal oxide.

123. (Currently Amended) ~~A method according to claim 122,~~ The method of claim 122,
wherein the metal oxide comprises: titanium oxide, zinc oxide, copper oxide, ~~aluminium~~
aluminum oxide, vanadium oxide, magnesium oxide, zirconium oxide, chromium oxide,
~~silicium~~ silicon oxide, molybdenum oxide, niobium oxide, tungsten oxide, ~~or~~ iron oxide, or
mixtures thereof.

124. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,
wherein the solid reactor filling material comprises a ceramic.

125. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,
wherein the solid reactor filling material comprises a metal ~~sulphate~~ sulfate.

126. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,
wherein the solid reactor filling material comprises a metal halide.

127. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,
wherein the solid reactor filling material comprises a metal oxide, a metal ~~oxid~~hydroxide
oxyhydroxide or a metal hydroxide identical to said product ~~resulting from the formation~~
formed in said reactor.

128. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,
wherein the solid reactor filling material ~~functions as~~ is a seed material for the ~~formation~~
forming of said product.

129. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,
wherein the solid reactor filling material ~~functions as~~ is a collecting agent for said product.

130. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,

wherein said product is separable from the solid reactor filling material with no further treatments of the solid reactor filling material.

131. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,

wherein said product is separable from the solid reactor filling material without substantially degrading the solid reactor filling material.

132. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,

wherein said product is separable from the solid reactor filling material in a way that allows the solid reactor filling material to be re-used as solid reactor filling material.

133. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,

wherein said product is separable from the solid reactor filling material by flushing the solid reactor filling material in a fluid.

134. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,

wherein said product is separable from the solid reactor filling material by vacuum means.

135. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,

wherein said product is separable from the solid reactor filling material by blowing means.

136. (Currently Amended) ~~A method according to claim 1,~~ The method of claim 1,

wherein said product is separable from the solid reactor filling material by ultrasonic means.

137. (Currently Amended) A metal oxide, metal ~~oxidhydroxide~~ oxyhydroxide, or metal hydroxide product manufactured by the method ~~according to~~ of claim 1, wherein the metal oxide, the metal ~~oxidhydroxide~~ oxyhydroxide, or the metal hydroxide product ~~is in the form of~~ comprises aggregates of primary particles with ~~an a maximum~~ average primary particle size of ~~maximum 1000 nm, maximum 500 nm, or maximum 100 nm.~~ 1000 nm, 500 nm, or 100 nm.

138. (Currently Amended) A metal oxide product manufactured by the method ~~according to~~ of claim 1, wherein the metal oxide, the metal ~~oxidhydroxide~~ oxyhydroxide or the metal hydroxide product ~~is in the form of~~ comprises aggregates of primary particles with ~~an a~~ maximum average primary particle size of 100 nm, ~~maximum 50 nm, maximum 20 nm, or maximum 10 nm.~~ 50 nm, 20 nm, or 10 nm.

139. (Currently Amended) A metal oxide product manufactured by the method ~~according to~~ of claim 1, wherein the metal oxide product is TiO₂, with a minimum crystallinity of ~~minimum 20%, minimum 30%, minimum 40%, minimum 60%, or minimum 80%.~~ 20%, 30%, 40%, 60%, or 80%.

140. (Currently Amended) A metal oxide product manufactured by the method ~~according to~~ of claim 1, wherein the metal oxide product is TiO₂ of anatase structure.

141. (Currently Amended) A metal oxide product manufactured by the method ~~according to~~ of claim 1, wherein the metal oxide ~~is selected from the group consisting of:~~ comprises: Al₂O₃, TiO₂, ZrO₂, Y₂O₃, WO₃, Nb₂O₅, TaO₃, CuO, CoO, NiO, SiO₂, Fe₂O₃, ~~and ZnO and~~ mixtures thereof.

142. (Currently Amended) A metal ~~oxidhydroxide~~ oxyhydroxide product manufactured by the method ~~according to~~ of claim 1, wherein the metal ~~oxidhydroxide~~ oxyhydroxide ~~is selected from the group consisting of:~~ comprises: iron ~~oxidhydroxide~~ oxyhydroxide, titanium ~~oxidhydroxide~~ oxyhydroxide, manganese ~~oxidhydroxide~~ oxyhydroxide, ~~and~~ aluminium ~~oxidhydroxide~~ oxyhydroxide, and mixtures thereof.

143. (Currently Amended) A metal ~~oxidhydroxide~~ oxyhydroxide product manufactured by the method ~~according to~~ of claim 1, wherein the metal ~~oxidhydroxide~~ oxyhydroxide is aluminium ~~oxidhydroxide~~ oxyhydroxide of Boehmite structure.

144. **(Currently Amended)** A metal hydroxide product manufactured by the method ~~according to~~ of claim 1, wherein the metal hydroxide ~~is selected from the group consisting of:~~ comprises: iron hydroxide, ~~silicium~~ silicon hydroxide, zirconium hydroxide, titanium hydroxide, manganese hydroxide, ~~and aluminium~~ aluminum hydroxide, and mixtures thereof.

145. **(New)** A metal oxide product manufactured by the method of claim 1,
wherein the metal oxide, the metal oxyhydroxide or the metal hydroxide product comprises aggregates of primary particles with a maximum average primary particle size of 100 nm, 50 nm, 20 nm, or 10 nm;

wherein the metal oxide product is TiO_2 , with a minimum crystallinity of 20%, 30%, 40%, 60%, or 80%; and,

wherein the metal oxide comprises: Al_2O_3 , TiO_2 , ZrO_2 , Y_2O_3 , WO_3 , Nb_2O_5 , TaO_3 , CuO , CoO , NiO , SiO_2 , Fe_2O_3 , ZnO and mixtures thereof.